

SECTION 34 21 50

COMMON MATERIALS AND METHODS FOR TRACTION POWER

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Buses and Connections
- B. MV Cables, Boots, Connectors, Splice and Termination Hardware, and Fire and Arc Proof Tape
- C. Low Voltage Dry Type and Isolating Transformers
- D. Low Voltage Molded Case Circuit Breakers
- E. Fiber Optic Transceivers/Media Converters
- F. Fiber Optic Cables, Splice Hardware and Connectors, and Patch Panels
- G. Lamp Holders and Light Fixtures
- H. Meters and Relays
- I. Transducers
- J. Switches
- K. Indicating Lights
- L. Low Voltage Wires and Cables
- M. Conduits, Cable Trays, Underground Ductbanks, Boxes and Mounting Hardware
- N. Wiring Devices and Covers
- O. Termination Blocks
- P. Low Voltage Connectors and Insulating Tape
- Q. Grounding and Bonding
- R. Sleeves & Associated Seals
- S. Fire Stopping System
- T. Miscellaneous Devices

1.02 RELATED SECTIONS

- A. Refer to the following Sections for requirements:

1. Section 01 33 00 Submittal Procedures
2. Section 01 33 23 Shop Drawings, Product Data, and Samples
3. Section 01 78 23 Operations and Maintenance Data
4. Section 20 50 13 Raceways for Facility Services
5. Section 20 50 16 Underground Ductwork and Structures for Facility Services
6. Section 23 81 00 Unitary HVAC Equipment
7. Section 26 05 17 Dry-Type Transformers
8. Section 26 05 24 Low Voltage Wires and Cables
9. Section 26 05 26 Grounding and Bonding
10. Section 26 24 24 Circuit Breakers and Panelboards
11. Section 26 50 00 Lighting
12. Section 27 13 01 Communication Cables and Related Equipment
13. Section 34 21 01 General Requirements for the Traction Power System
14. Section 34 21 19 Separable Insulated Connectors
15. Section 34 21 55 Manual DC Disconnect Switch
16. Section 34 21 56 34.5KV Isolation Disconnect Switches
17. Section 34 21 60 Grounding and Bonding for Traction Power Facilities
18. Section 34 21 70 Traction Power Facilities Installation Requirements
19. Section 34 21 75 Traction Power Facility System Factory Functional Testing
20. Section 34 21 80 Traction Power System Final Acceptance Testing
21. Section 34 22 23 Traction Power Cables

1.03 MEASUREMENT AND PAYMENT

- A. Separate measurement and payment will not be made for work required under this Contract Specifications Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

1.04 REFERENCES**A. American Society for Testing and Materials (ASTM):**

1. ASTM B766 Standard Specification for Electrodeposited Coatings of Cadmium
2. ASTM E84 Standard Test for Surface Burning Characteristics of Building Materials

B. International Electrotechnical Commission (IEC)

1. IEC 60051-1 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories- Part 1: Definitions and General Requirements Common to All Parts
2. IEC 60051-4 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 4: Special Requirements for Frequency Meters
3. IEC 60051-5 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 5: Special Requirements for Phase Meters, Power Factor Meters and Synchroscopes
4. IEC 60051-6 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 6: Special Requirements for Ohmmeters (Impedance Meters) and Conductance Meters
5. IEC 60051-7 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 7: Special Requirements for Multi-Function Instruments
6. IEC 60051-8 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 8: Special Requirements for Accessories
7. IEC 60051-9 Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories Part 9: Recommended Test Methods

C. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE C37.90 Standard for Relays and Relay Systems Associated with Electric Power Apparatus
2. IEEE C37.90.1 Standard for Surge Withstand Capability (SWC) Tests for Relay and Relay Systems Associated with Electric Power Apparatus
3. IEEE C57.13 Relay Requirements for Instrument Transformers

4. IEEE 383 Standard for Type Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
- D. National Electrical Manufacturers Association (NEMA):
 1. NEMA C12.1 Electric Meters – Code for Electricity Metering
 2. NEMA FG 1 Fiberglass Cable Tray Systems
 3. NEMA VE 1 Metallic Cable Tray Systems
- E. National Fire Protection Agency (NFPA):
 1. NFPA 70 National Electrical Code
- F. Underwriters Laboratories Inc. (UL):
 1. UL 94 Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.05 SUBMITTALS

- A. Refer to the following Sections for additional requirements:
 1. Section 01 33 00 Submittal Procedures
 2. Section 01 33 23 Shop Drawings, Product Data, and Samples
- B. Submit:
 1. Data sheets for conduit support bracing, conduits and raceway accessories.
 2. Product data for meters, relays, instrument transformers, transducers, control switches, low voltage and communication wiring and cables, raceways and miscellaneous auxiliary devices.
 3. Operations and Maintenance Manuals: Provide Operations and Maintenance Manuals in accordance with Section 01 78 23, Operations and Maintenance Data. Standard off the shelf manuals shall be submitted as Pre-Final Manuals.

1.06 QUALITY ASSURANCE

- A. Refer to Section 34 21 01, General Requirements for the Traction Power System, and Section 34 21 70, Traction Power Facilities Installation Requirements, for requirements.
- B. Electrical components, devices, and accessories shall be listed and labeled in conformance with NFPA 70, Article 100.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 34 21 70, Traction Power Facilities Installation Requirements, for requirements.

1.08 GENERAL REQUIREMENTS FOR THE TRACTION POWER SYSTEM

- A. Refer to Section 34 21 01, General Requirements for the Traction Power System, for requirements.

PART 2 –PRODUCTS**2.01 BUSES AND CONNECTIONS**

- A. Buses shall be made of round edge rectangular, high conductivity, rigid copper bars and shall be of sufficient size to carry the continuous rated current, without exceeding the temperature limits indicated in the applicable ANSI, NEMA, and IEEE standards for the specific equipment.
- B. The buses shall be supported and braced between each other and to the enclosure with high strength anti-hygroscopic, flame retardant, non-tracking insulators, so that the buses can withstand the thermal and mechanical stresses due to short-circuit currents equal to the maximum symmetrical interrupting and three-second short time current ratings of the circuit breaker protecting the bus.
- C. Bus taps and connections shall be welded or bolted:
 - 1. All bolted bus connections shall be acid etched and plated with electro-deposited silver after buses have been bent or formed. Bending after the plating process is not allowed.
 - 2. Bolted connections shall utilize Bellville-type washers and high strength, rust resistant steel bolts, such as cadmium-plated or galvanized. Bolts shall pass through the bus bar conductors, and shall be capable of being properly torqued and locked in place, to provide and maintain full and uniform pressure under all operating conditions.
- D. Bus joints shall have conductivity at least equal to that of the bus bar, and each joint shall be so clamped that no loss of conductivity will occur during the life of the equipment.
- E. Access plates shall be provided to permit assembling joints and inspecting all bolted connections after installation of the bus enclosure.

2.02 MV CABLES (35 KV, 2400 V), BOOTS, CONNECTORS, SPLICE AND TERMINATION HARDWARE, FIRE AND ARC PROOF TAPE

- A. Refer to Section 34 21 19, Separable Elbow Connectors and Section 34 22 23, Traction Power Cables, for product and installation requirements.

2.03 LV DRY TYPE POWER AND ISOLATING TRANSFORMERS

- A. Refer to Section 26 05 17, Dry Type Transformers, for product and installation requirements.

2.04 LV MOLDED CASE CIRCUIT BREAKERS

- A. Refer to Section 26 24 24, Circuit Breakers and Panelboards, for product and installation requirements.

2.05 FIBER OPTIC TRANSCEIVERS/MEDIA CONVERTERS

- A. Refer to Section 27 13 01, Communication Cables and Related Equipment, for product and installation requirements.

2.06 FIBER OPTIC CABLES, SPLICE HARDWARE AND CONNECTORS, PATCH PANELS

- A. Refer to Section 27 13 01, Communication Cables and Related Equipment, for product and installation requirements.

2.07 LAMP HOLDERS AND LIGHT FIXTURES

- A. Refer to Section 26 50 00, Lighting, for product and installation requirements.

2.08 METERS AND RELAYS

- A. Metering and relaying devices, and similar devices, shall be provided, wired, and connected as indicated.
- B. Additional components, such as auxiliary relays, isolating diodes, and other devices not indicated but required for a complete fully functional system, shall be furnished and installed.
- C. Each relay and device shall have a sealed dust cover, which shall keep the inside of the case free of dust and moisture.
- D. Protective devices provided shall prevent damage to the individual parts of the equipment due to short-circuit, loss of cooling, transient voltage conditions and overloads.
- E. All protective relays in the AC switchgear and DC switchgear shall be solid-state type. Control and auxiliary relays shall be electro-mechanical type. Solid-state type auxiliary relays are acceptable provided their output contacts, if required to interface with other systems such as SCADA, are independent and potential free:
 - 1. Unless stated otherwise, relays requiring control power shall be able to operate properly with station battery voltage of 125 V DC, with fluctuations of plus or minus ten percent.

2. All relay contacts shall be properly rated for the intended duty, and shall meet the required performance with no less than 50 percent spare margin at the expected worst-case operating condition.
- F. All protective relaying shall be provided with separate contacts for each operating element, and shall have indicating targets to show operation of the relay element. Drawout type relays shall be installed in their cases prior to final inspection and shipment.
- G. All protective devices shall be coordinated to prevent false tripping or malfunction, to protect against damage to equipment, property, and personnel, and to assure continuity of operation.
- H. Relays and devices suitable for semi-flush mounting shall be of the flexitest-type or of the drawout type with flat black finish and shall be mounted on panels or doors.
- I. Relays and devices not suitable for semi-flush mounting shall be surface mounted to mounting brackets on panels within enclosures or on the inside of the doors.
- J. Indicating instruments shall be semi-flush mounted on the front panels and shall have LED readouts.
- K. Relays and devices in which any of the elements are subjected to 1,000 V DC potentials shall be mounted on an insulating base inside the high voltage compartment.
- L. Solid state relays shall be of the Schweitzer Engineering Laboratories, Inc. (SEL), Basler Electric, General Electric or approved equal.
- M. Lockout Relays:
1. Lockout relays shall be high-speed, multi-contact, hand reset type with oval handles and mechanical targets which indicate whether the relays are in the tripped or reset position.
 2. Lockout relays shall be Electros witch Series 24, General Electric Type HEA, Westinghouse Type WL, or approved equal.
- N. Interposing (Auxiliary) Relays:
1. Interposing (auxiliary) relays shall be plug-in type and include dust covers and be rated for ten amperes.
 2. Relay coil shall be able to pickup by momentary contact closure of 300 ms and its contacts shall stay closed until the circuit breaker or the end device completes its operation. If operation is not completed within the normal time, the relay coil shall reset automatically.
 3. Contractor shall coordinate with BART engineer the duration of the remote control signals from the District's OCC with the pickup times of the interposing

relays in the traction power facilities to ensure the remote commands do reach and activate the end device of the intended equipment.

- O. Meters: All meters shall be switchboard type for semi-flush mounting. The cases shall be dust tight, with dull black finish, and covered with a non-reflecting glass window:
1. Ammeters, wattmeters, watthourmeters, varhour meters and voltmeters shall be solid-state type with digital LED readouts that cover the full range of operation including overload conditions. The LED readouts wattmeters, watthour meters and varhour meters shall be able to read nine digits and self-reset to zero after maximum reading is reached. The ammeters and voltmeters shall be able to read 6 digits.
 2. The accuracy of all indicating instruments shall be within one-half percent of the actual value. The indicating instruments shall have true RMS sensing.
 3. AC voltmeters at the 34.5 kV AC circuit breakers, either in the form of digital display of the incoming voltage on the IPR or as separate voltmeters. The calibration shall be line-to-line voltage. The metering data shall be sent also for remote indication on the CO2 panel in the DC house, from where the data shall be re-transmitted to the BART maintenance computers. The scan rate for remote indication shall be one second or less. DC voltmeters shall receive inputs from voltage transducers via the CO2 PLC, as indicated.
 4. AC ammeters at the 34.5 kV AC circuit breakers, either in the form of digital display on the IPR of the current flowing through the incoming line monitored by the IPR, or as separate ammeters. Provide capability of monitoring the current of each phase. The metering data shall be sent also for remote indication on the CO2 panel in the DC house, from where the data shall be re-transmitted to the BART maintenance computers. The scan rate for remote indication shall be one second or less. DC ammeters shall receive inputs from metering shunts, via current transducers and the CO2 PLC, as indicated.
 5. Ammeter and voltmeter switches to monitor the three-phase ac current and voltage, respectively, shall be provided.
 6. Wattmeters shall be rated on a mA for connection to wattmeter transducers.
 7. The watthour and varhour meters shall have drawout construction and shall be transformer rated, 120 V, 5 A, with suitable range equal to the associated potential and current transformers. The meters shall be furnished with an accumulator.

2.09 TRANSDUCERS

- A. General: Except for the AC watt-hour and var-hour transducers specified in Article 2.09D below, and the isolation transducer for the DC MPR, output range of all transducers shall be either four to 20 mA, or zero to five V signals.

B. AC Current Transducers:

1. Operating input range shall be single phase, zero to five amperes, 60 Hz with overload capability of 20 amperes continuous and 250 amperes for 1.0 second.
2. Burden shall not exceed 2.0 VA at 60 Hz.

C. AC Voltage Transducers:

1. The nominal input voltage to each ac voltage transducer shall be single phase, 120 V, 60 Hz. The operating input range shall be 0 to 150 V AC with continuous overload capability to 180 V AC.
2. Burden shall not exceed 2.5 VA at 120 V AC, 60 Hz.
3. The maximum allowable error shall not exceed plus or minus 0.25 percent of full scale at 25 degrees Celsius. AC output ripple shall not exceed one percent.
4. The error resulting from a temperature variation between minus 20 degrees Celsius and 60 degrees Celsius shall not exceed plus or minus 0.5 percent of full scale.
5. The unit shall be provided with a ten percent of full-scale calibration adjustment. The response time shall be 400 ms or better from 0 to 99 percent.
6. The unit shall withstand a dielectric test of 1,500 V RMS.

D. AC Watthour and Varhour Transducers:

1. The potential input to the watthour and varhour transducers shall be 120 V AC, 60 HZ nominal, 0 to 150 V operating range, 180 V overload and 4 VA burden at nominal voltage.
2. The current input shall be five amperes nominal, 0 to 20 amperes operating range, 250 amperes overload for one second and 0.25 VA burden.
3. The maximum allowable error shall not exceed plus or minus 0.2 percent of full scale at 25 degrees Celsius. The transducer shall be provided with a ten percent of full-scale calibration adjustment. The full-scale calibration shall be rated in accordance with the instrument transformer (potential or current) ratios.
4. The response time shall be 400 ms or better from 0 to 99 percent range.
5. Signal from transducers shall be pulses that can be sensed by a SCADA discrete input module. Transducers shall be calibrated so that each pulse represents a given number of KWH or KVARH units. Pulse rate at normal full load shall not exceed one pulse per second. Pulse duration shall be more than 100 ms and less than 150 ms.

E. Temperature Transducer:

1. The temperature input range shall be coordinated with type of Resistance Temperature Detector (RTD) supplied with the rectifier transformer.
2. The output range shall be suitable for the temperature class of the rectifier transformers.

F. DC Voltage Transducers:

1. DC voltage transducers shall be insulated for operation at 4,600 V dc for one minute. The operating input range shall be 0 to 1,500 V DC.
2. The maximum allowable error shall not exceed plus or minus 0.5 percent of full scale at 25 degrees Celsius. Temperature coefficient shall not exceed plus or minus 0.04 percent per each degree Celsius. Load resistance variations from 0 to 10,000 ohms shall affect the output current no more than 0.1 percent.
3. The input circuit shall be completely isolated from all other circuits and grounds. The output circuit shall include internal filtering.
4. Zero and gain adjustments shall be accessible from outside the case.

2.10 SWITCHES

A. Control and Selector Switches:

1. Control and selector switches shall be rotary, cam-operated, multi-stage type, suitable for switchboard mounting with a rectangular, front panel engraved escutcheon plate showing the switch positions. The switches shall be Electroswitch Series 24, Westinghouse type W-2, or General Electric type SB-1, or approved equal.
2. Control switches shall have the following types of handles:
 - a. Circuit breaker control switches shall have pistol-grip handles.
 - b. Instrument selector switches shall have round knurled handles.
 - c. Local-remote transfer selector switches shall have oval handles.
3. Switch contacts shall be silver-plated, self-cleaning, readily renewable type, and shall have adequate insulation and contact surface. Switches shall be installed so that mating contact surfaces are parallel.
4. Breaker control switches shall be spring-return to neutral type with pull and lockout position, and shall be furnished with mechanical indicating devices (red and green target) to show the last operation of the switch.
5. The Contractor shall determine the number of stages and contact wiring arrangement for each switch, depending on the application. Each switch shall be provided with at least two spare stages.

6. Switches shall be rated for a mechanical life of not less than 500,000 operations. Electrical ratings shall be 600 V, 20 A continuous.
7. Tight-fitting dust covers shall keep the operating and contact parts of the switches clean.

B. Test Switches:

1. Test switches shall be provided for all ammeters and voltmeters, and between all instrument transformers and the protective relays supplied by these transformers.
2. Each test switch group shall be mounted in a semi-flush case of uniform size, capable of holding at least six current positions and four voltage positions. A convenient, dull black cover shall permit covering the test switches and contacts when they are not in use.
3. At the switching stations, test switches in current transformer circuits shall be seven-pole, with three straight test jack assemblies, one through bar, and three single-pole current assemblies, left hand, working as one unit.
4. Test switches for the current transformers shall be of the type that do not disturb the permanent wiring and do not interrupt the current transformer circuit when the switch is used
5. The test switches shall be specifically designed for use in AC instrumentation circuits, and shall be UL listed. Test switches shall be by States, Superior, Meter Devices, or approved equal.
6. Test switch shall be used to isolate current and voltage inputs to the protective relays and to cut-off relay trip output.

2.11 INDICATING LIGHTS

A. Indicating lights for equipment in the traction power facilities shall be based on light emitting diode (LED) lamps. The LED lamps shall be replaceable, with built-in resistor and high dielectric strength for reverse voltage protection. The LED lamps shall be:

1. Suitable for use with 125 V DC control system voltage;
2. Capable of operating over a voltage range from plus 15 percent to minus 30 percent of the nominal;
3. Designed with bayonet bases;
4. Mounted in compact, rugged sockets; and
5. Readily replaceable from the front.

- B. Lenses and bezels shall be rectangular or circular, 1-3/8 inch maximum width and height and shall permit reading from oblique angles.
- C. LEDs shall be rated for 100,000 hours at full voltage, and shall be clearly visible at an angle of 30 degrees and at 15 feet in a fully lit environment.

2.12 LV WIRES AND CABLES

- A. Refer to Section 26 05 24, Low Voltage Wires and Cables, and Section 34 21 70, Traction Power Facilities Installation Requirements, for product and installation requirements.

2.13 CONDUITS, CABLE TRAYS, UNDERGROUND DUCTBANKS, BOXES AND MOUNTING HARDWARE

- A. Refer to Section 20 50 13, Raceways for Facilities Services, and Section 20 50 16, Underground Ductwork and Structures for Facility Services, for the product requirements relating to raceways, cable trays, underground ductbank, mounting hardware, fittings and appurtenances.

2.14 WIRING DEVICES (I.E. RECEPTACLES, TOGGLE SWITCHES & OCCUPANCY SENSORS) AND COVERS

- A. Refer to Section 20 70 26, Common Materials and Methods for Electrical Systems and Section 26 50 00, Lighting, for product and installation requirements.

2.15 TERMINATION BLOCKS

- A. Refer to Section 20 70 26, Common Materials and Methods for Electrical Systems, for product and installation requirements.

2.16 LV CONNECTORS AND INSULATING TAPE

- A. Refer to Section 20 70 26, Common Materials and Methods for Electrical Systems, for product and installation requirements.

2.17 GROUNDING AND BONDING (CONDUCTORS AND MATERIALS)

- A. Refer to Section 34 21 60, Grounding and Bonding for Traction Power Facilities, for product and installation requirements.

2.18 MISCELLANEOUS DEVICES

- A. Space Heaters: Thermostatically- and humidistatically-controlled space heaters shall be provided in all enclosures, and in separate compartments within enclosures, to keep the equipment temperature above the dew point and avoid condensation. Space heaters shall operate from the 120 V, single-phase, 60 Hz supply, and the

circuits shall be protected by circuit breakers. Space heaters shall be provided with laminated phenolic nameplates.

- B. Current Shunts: Current shunts shall be used to provide dc millivolt signals as input to current measuring instruments and relays, as indicated. Current shunts shall be of rugged design and suitable for in-line busbar mounting. Shunt output shall be 50 mV nominal, with accuracy plus or minus 0.25 percent. The Contractor shall determine the current rating of the shunt, as suitable for the application.

PART 3 – EXECUTION

3.01 FACTORY TESTING

- A. Refer to Section 01 45 24, Testing Program Requirements and Section 34 21 75, Traction Power Facility Factory Functional Testing, for additional requirements.
- B. Test Types: Unless otherwise indicated, design tests on common materials and methods for the Traction Power System that are standard products of manufactures or off-the-shelf items that have not been specifically configured (hardware / firmware and/or software) to meet the District's requirements for this Contract, are not required. Production tests shall be performed in accordance with the requirements defined herein, and as needed to ensure a correctly assembled and properly functioning installation.
- C. Relays, Meters, Transducers and Instrument Transformers:
 - 1. Relays, meters, transducers and instrument transformers shall be tested in the factory for accuracy, performance, operation, and correct setting and calibration, per NEMA C12.1, IEEE C37.90, IEEE C39.1 and IEEE C57.13. The Contractor shall be responsible for relay coordination.
 - 2. Relay and transducer testing, setting, and calibration shall be separately bench-tested from the overall inspection and testing. Relays and transducers shall be tested in accordance to IEEE C37.90.1 for surge withstand capability, except where certified test reports are available for the same model to prove that such tests have been passed successfully by identical equipment.
 - 3. Test current and voltage shall be injected into the current and voltage circuits at the instrument transformer terminals to ensure that the protective relays are polarized correctly and trip the respective circuit breakers as designed, and to ensure that instruments read correctly and meters are calibrated accurately.
 - 4. Instruments and transducers shall be checked for accuracy at quarter, half, three-quarters and full-range points.
 - 5. After the relays have been calibrated with the proper settings, provide the following:

- a. Solid state relays: Provide a sheet stating settings and date of calibration in a plastic jacket mounted in the relay cabinet or on the wall adjacent to the switchgear.
 - b. Electromechanical relays: Provide a small white card stating the settings and date of calibration placed in the relay case.
- D. Factory Installed Low Voltage Wires and Cables:
 - 1. Verify in the factory that the wiring conforms to the approved control schematics and wiring diagrams. Wiring continuity and proper termination shall be checked completely, including interconnections at shipping splits.
 - 2. All wiring within equipment enclosures, and among equipment enclosures shall be tested as described below:
 - a. All wiring shall be checked for accuracy, intended functionality, ground connections, and insulation integrity by means of high potential, continuity, and operations tests.
 - b. All 1,000 V DC wiring shall be given a high-potential test of 6,800 V DC or 4,600 Vac, 60-Hz voltage to ground for one minute. All other low voltage wiring shall be subjected to 1,500 V, 60-Hz voltage to ground for one minute.
 - c. Insulated cables and wires shall be certified to have passed the design and production test in accordance with the applicable ICEA, IEEE and NEMA standards, including the flame propagation test.

3.02 INSTALLATION

- A. Refer to Section 34 21 01, General Requirements for the Traction Power System, and Section 34 21 70, Traction Power Facilities Installation Requirements, for additional requirements.
- B. Installation of common materials and methods for traction power shall conform to the recommended practices of the applicable ANSI, IEEE and NEMA standards; shall be in accordance with the accessibility, clearance, conformity, and arrangement requirements of Section 34 21 01, General Requirements for the Traction Power System, Section 34 21 70, Traction Power Facilities Installation Requirements, and as indicated.
- C. Where interior or exterior GRS conduits containing 1,000 V DC system positive and negative cables are installed within one foot of each other, or in parallel with GRS grounding system conduits, provide conduit bracing of sufficient strength to inhibit distortion due to mechanical forces generated by DC system faults of 100,000 amperes.

END OF SECTION 34 21 50